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Effects on beam alignment due to neutron-irradiated CCD images at the National Ignition Facility

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The 192 laser beams in the National Ignition Facility (NIF) are automatically aligned to the target-chamber center using images obtained through charged coupled device (CCD) cameras. Several of these cameras are in and around the target chamber during an experiment. Current experiments for the National Ignition Campaign are attempting to achieve nuclear fusion. Neutron yields from these high energy fusion shots expose the alignment cameras to neutron radiation. The present work explores modeling and predicting laser alignment performance degradation due to neutron radiation effects, and demonstrates techniques to mitigate performance degradation. Camera performance models have been created based on the measured camera noise from the cumulative single-shot fluence at the camera location. We have found that the effect of the neutron-generated noise for all shots to date have been well within the alignment tolerance of half a pixel, and image processing techniques can be utilized to reduce the effect even further on the beam alignment.

Key words: Neutron irradiated CCD, Neutron induced Noise modeling, Laser alignment

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